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WASHINGTON, D.C.

January 24, 1997

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Room 222
1919 M Street, N.W.
Washington, D.C. 20554

Re: Reply Comments of Association of Federal Communications Consulting Engineers (AFCCE)

Dear Mr. Caton:

Enclosed are 11 copies (original and 10) of the response by the Association of Federal Communications Consulting Engineers (AFCCE) regarding, In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service, MM Docket 87-268.

If there are any questions, please do not hesitate to contact this office.

Sincerely,

Donald G. Everist

DGE:mcw
Enclosure

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ASSOCIATION OF

FEDERAL COMMUNICATIONS CONSULTING ENGINEERS

WASHINGTON, D. C.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service	)))))	MM Docket No. 87-268

REPLY COMMENTS

of the

Association of Federal Communications Consulting Engineers

to comments filed in response to the

SIXTH FURTHER NOTICE OF PROPOSED RULE MAKING

The Association of Federal Communications Consulting Engineers (AFCCE) respectfully submits these Reply Comments in the above-captioned proceeding. AFCCE submitted timely comments to the Sixth FNPRM and, in these reply comments, will attempt to respond to some of the comments filed by other parties.

AFCCE notes that the sheer volume of comments filed in response to the Sixth FNPRM is indicative of the heightened interest in ATV/DTV on the part of the broadcast industry; it is this volume of comments which prevents AFCCE from thoroughly reviewing and preparing adequate reply comments to the filings of all parties. AFCCE had requested an extension of two months (beyond the original December 23, 1996 reply comment date) so that it could more

properly review and reply where appropriate[1/]. In submitting these somewhat truncated comments, AFCCE also notes that it has received some comments directly from various parties regarding its Comments filed in response to the Sixth Notice; some of these comments are also addressed in these reply comments.

Comments of MSTV and Broadcaster's Caucus

AFCCE again compliments MSTV and Broadcaster's Caucus for their untiring work in these proceedings; their efforts have served to move the process forward on a timely basis. AFCCE has suggested in its comments that the planning factors proposed by ACATS, and the modified version thereof proposed by MSTV and the Commission, may not employ optimal parameter values; further, the principles underlying the replication methodology, used in determining the power (ERP) assigned to individual facilities in the table of allotments, are based in part on these planning factors. AFCCE believes that one of the results of this process is the calculation of extremely low DTV ERP's for some UHF NTSC stations while some VHF stations have been allotted extremely high DTV ERP's; there are numerous examples of DTV ERP's of stations in the same city varying by factors approaching 20 dB (100:1) , particularly in the MSTV proposal where no minimum ERP is specified[2/].

National Radio Astronomy Observatory (NRAO)

NRAO addresses two principal issues in its comments. First, is the problem of adjacent channel facilities, i.e., TV transmitters on channels 36 and 38, situated in close geographic proximity to NRAO VLBA facilities utilizing the spectrum formerly allocated for TV channel 37.

[1/] AFCCE is appreciative of the two extensions granted by the Commission, in part in response to the AFCCE request, which totaled approximately one month.

[2/] The Commission proposes a 50 kW minimum ERP (UHF).

To the extent that NRAO's request that the Commission provide greater geographic separation between the DTV and VLBA facilities can be accommodated without adversely affecting broadcaster's needs, AFCCE agrees that the Commission should do so. (However, the guiding principles should continue to be the Commission's rules as noted below.)

NRAO's second concern is related to the second and third harmonics of UHF TV carriers which fall in the range of frequencies between 1400 MHz and 1427 MHz. NRAO has cited – as it has in many other proceedings – the "requirements" of ITU Recommendation ITU-R RA.769 (1994) "Protection Criteria Used for Radioastronomical Measurements". The operative word here is "recommendation"; the Commission's rule governing the use of this band and others for radio astronomy purposes is quite simply stated in Section 2.106 of its Rules and Regulations as follows:

> Footnote US 74 (Section 2.106)
>
> *"In the band(s)...608-614, 1400-1427, ...MHz ....., the radio astronomy service shall be protected from extraband radiation only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates"* (emphasis added).

NRAO continues its mission to have the Commission impose the responsibility for mitigation of interference to its receivers of ever-increasing sensitivity on the broadcast stations. The Commission should continue to deny these requests; however, it would be appropriate for broadcasters to cooperate with NRAO, even to the extent of modifying their facilities to accommodate the installation of additional filtering or shielding, provided that NRAO assumed responsibility for all costs associated with such modifications and, further, that such modifications (e.g., filters) do not impair the technical performance of the station (other than negligible insertion losses).

Comments of Motorola, Inc.

In its comments, Motorola presents a very good review of the Commission's simulated annealing methodology. AFCCE agrees with Motorola's conclusion that the results of the simulated annealing process depend in large measure on the starting parameters (choice of first market, for example), and the nature of the penalties applied. The use of "soft" penalties rather than the hard limits applied by the Commission could result in a completely different table of allotments. Also, while a solution may be obtained, it may not be the best solution. AFCCE encourages the Commission to review this aspect of its simulated annealing methodology.

AFCCE does, however, wish to address apparent discrepancies in Motorola's comments, particularly in Appendix B wherein it purports to compute expected interference to Land Mobile Radio (LMR) facilities in bands adjacent to DTV facilities. Motorola's use of FCC curves to predict interference at an LMR site 250 km distant from a high power DTV facility is offered as an example of one of several discrepancies. First, Motorola assumes that the cross-polarization component (vertically polarized signal from a horizontally polarized antenna) is only -20 dB at the horizon (main beam). Measured data from antenna manufacturers indicates this component may be closer to -30 dB in typical antennas; it is recognized that propagation anomalies could result in depolarization of the signal such that the cross-polarization discrimination is less than these values, however, Motorola did not address this aspect of its hypothetical case. Secondly, Motorola uses the FCC curves to predict interfering signal levels at a distance of 250 km when the Commission has stated that these curves are based on empirical data only to a distance of 50 km or so. Also, in the DTV matter, the Commission has made extensive use of the Longley-Rice propagation models which, over a path of 250 km, will invariably predict a different field strength under "real world" conditions. Finally, Motorola uses an antenna height-gain relationship (Appendix B, Section 3.5) that provides a 30 dB "correction" because the hypothetical LM antenna is at 1,000 feet AGL instead of 30 feet AGL. The use of the height-gain relationship has been typically used to correct for antenna heights lower than 30 feet where it has been assumed (but not generally agreed) that the signal level at the antenna would, for example in the case of an antenna at

10 feet, be approximately 10 dB less (20 log 30/10) . Motorola's use of this relationship is questionable, to say the least. Another minor factor, which would have worked to Motorola's advantage if properly applied, is the inadvertent use of antenna gains in dBd instead of dBi in the computations shown in 3.8.

All-in-all, Motorola's computations and, therefore, its conclusions, appear to be flawed. Interestingly, the net differences discussed above could easily exceed 30 dB; since the degradation of the hypothetical receiver is calculated by Motorola to be 16.7 dB, it is intuitively obvious that a proper calculation may have shown that there would be no impact at all on the LMR receiver by the hypothetical DTV transmitter.

AFCCE recognizes the concerns of LMR parties regarding interference from adjacent DTV stations and so stated in its Comments. AFCCE suggested that the Commission address the band-edge channel issues particularly with respect to the power levels of facilities assigned to channel 14 or 69 (or adjacent channels to LMR facilities in the TV broadcast band) and reiterates that request.

High Power Levels

Some commentators[3/] express the same concern that AFCCE stated in its comments to the effect that the achievement of extremely high DTV ERP's (up to 5 megawatts) may be impractical because of technical limitations of equipment as well as because of economic constraints (construction and operating costs); AFCCE concurs. Other concerns related to these high average power levels include intermodulation and high Radio Frequency Radiation levels.

[3/] Media General & Park Acquisitions, for example.

Coordination with Canada and Mexico

Several commentators[4/] have expressed concerns regarding the status of negotiations with Canada and Mexico regarding border-area allotments. Neither the Commission's table nor the MSTV/Caucus table reflect DTV allotments in these countries and the concern is whether allotments made now to cities such as Detroit, Cleveland, and Buffalo or El Paso, Tucson and San Diego will "survive" future negotiations with the Canadian and Mexican administrations; the possibility exists for a U.S. station to be satisfied now with its allotment only to be later faced with having to accept a revised allotment – perhaps a less desirable one – as the result of trans-border agreements. AFCCE reasserts its earlier concerns regarding this matter and also suggests that the "core spectrum" proposal will further exacerbate this perceived problem by limiting the spectrum available to deal with border area assignments.

Use of "Beam Tilt" to Increase Effective UHF Service

It has been suggested that UHF DTV stations, particularly those with relatively low ERP, can optimize their service by use of antenna beam tilt to contain their limited power within the Grade A contour or the radio horizon. Except in cases where an extreme antenna height is employed (e.g., a mountain-top site), the point of maximum field on the antenna elevation (vertical) pattern is typically "tilted" to the effective radio horizon or slightly below it. Thus, the relative field in the area between the Grade A contour and the radio horizon (typically, there will be only a small difference in distances to these points) will be well in excess of 90% of the maximum field value. Thus, beam tilt adjustments will result in only minor improvement in field strength (on the order of 1 dB or less). This is insignificant.

[4/] RGV Educational Broadcasting and Channel 51 of San Diego, Inc., for example.

The elevation pattern designs of most UHF broadcast antennas attempt to approximate a cosecant-squared function such that the ground-level field strength will be more uniform in the area close to the transmitter served by the portion of the pattern below the "main beam"[5/].

The station could use a lower gain antenna to increase the power (and field strength) directed towards receivers much closer to the transmitter without significantly increasing the power directed towards the radio horizon; this might provide a marginal improvement for indoor reception very close to the transmitter but would do little or nothing for locations beyond 10 km or so from that site.

Thus, it appears that there is little to be gained from antenna elevation pattern or beam tilt adjustments in overcoming the effects of low ERP.

Intermodulation

There are existing situations in several cities (including Milwaukee and Philadelphia) where carriers from nearly colocated high power VHF and UHF stations effectively overload the front-ends of consumer receivers (particularly those connected to an outdoor antenna). When the appropriate algebraic relationships exist among assigned operating frequencies, the result is receiver-induced intermodulation between two or more channels which causes interference to the reception of another channel. (In Milwaukee it is Channel 12 and Channel 24 adding to fall on Channel 58; in Philadelphia it is Channel 12 and Channel 23 combining to form an interfering product on Channel 57.)

The addition of multiple new DTV transmitters into these or other markets may result in significant intermodulation issues particularly if the DTV transmitters are of the high power variety. While it may be appropriate to assume that a new-design DTV receiver could be

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[5/] For a typical medium gain antenna having a beam tilt of 0.75° (such as the type envisioned for DTV stations) employed at a facility having an effective antenna height of 300 meters, the -3 dB point on the elevation pattern (or 70% relative field) will be at a depression angle of 2.0°; this corresponds to a distance of approximately 8.9 km from the transmitter.

configured to deal with receiver generated intermodulation, it is clear that the existing population of NTSC receivers cannot. In the New York City market, for example, Channel 7 (NTSC) and Channel 18 (DTV) could combine to adversely affect Channel 47 (NTSC).

Among the solutions for NTSC receivers would be the addition of filters or pads to reduce the signal levels below that which would create the intermodulation scenario. In the latter case, however, such pads would also reduce the signal levels of more distant stations, perhaps to the point that they are unusable. While this problem could be resolved or minimized with lower DTV ERP, the appropriate resolution may include selection of channels which do not present a new intermodulation threat to existing NTSC stations.

Indoor Reception

Some parties have raised the issue of DTV reception on indoor antennas particularly in regard to the difficulties in rendering such service if a station is operating with a very low ERP [e.g., 1 kW (VHF) or less than 50 kW UHF]. Planning factors defining TV service have historically been based on the use of an outdoor antenna. Indoor reception is provided close-in to NTSC VHF/UHF transmitters by virtue of the very high field strength in these areas but not specifically provided-for in the planning factors.

For DTV reception, adequate signal strength is not the only criterion; it is entirely possible that reception of an extremely high level signal will not guaranty that a DTV signal will be decoded. Propagation phenomena, particularly multipath effects, can significantly corrupt the digital signal even to the point of producing distortion that is beyond the range of the receiver equalizer. Within 15 km of a transmitter site, the signal strength from a moderate or high power transmitter should be adequate to produce sufficient signal level at an indoor antenna to provide DTV service assuming that distortions due to propagation anomalies are within the correction capabilities of the receiver equalizer; this capability is not a "given" which will always result in the decoding of a usable signal. Signal level certainly is an issue when considering indoor reception but further work needs to be done to determine minimum requirements in "typical" indoor reception scenarios.

Smart LNA

In its Comments, AFCCE proposed the use of a "smart LNA" to provide service (and the same level of "replication" proposed by the FCC) beyond the effective radio horizon. AFCCE suggested that the LNA would be mounted at the terminals of the receiving antenna and integrated electronically with the receiver which would provide a biasing signal to the LNA developed-from and dependent-on the signal levels detected by the receiver.

AFCCE also suggested that multiple receivers could be fed from a single integrated antenna/LNA. Since it would have to be assumed that each receiver would be tuned to a different channel, the LNA state (bias) would have to optimized for all three receivers. AFCCE has confirmed that such control is possible and quite simple to achieve.

In more sophisticated installations, perhaps where reception of a relatively weak distant signal may be desired in an area where one or more "local" stations are sited, it may be necessary to consider the use of an electronically tuned preselector for the LNA to prevent overload conditions due to the strong signals.

Conclusion

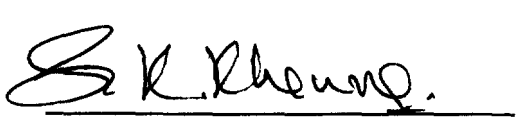
AFCCE committee members have received comments from various industry sources implying that it appears – at least to some of the commenters – that AFCCE's efforts may result in a delay of the process and, in so doing, may jeopardize the prospects of the industry to obtain adequate spectrum for the DTV service and, further, delay its timely implementation. AFCCE has previously stated and hereby reiterates that its objective has always been to ensure that a sound technical basis exists for the implementation of what will, hopefully, become the foundation of the over-the-air broadcast television service for the next 60 years (assuming DTV has as long a "run" as NTSC). At the heart of the body of technical issues is the matter of assumed planning factors; these factors directly affect channel allotments, transmitting power levels and service (as limited by interference and signal strength).

AFCCE has proposed an alternative to the various sets of planning factors now under discussion (i.e., ACATS, FCC and MSTV); AFCCE does not claim it has all the right answers to the difficult questions which it believes have not been adequately addressed. To this end, AFCCE has proposed the re-establishment of a TASO-like organization to address the issues which can be classified under the heading of "Require Further Study". AFCCE's proposal for TASO-II is not intended to obstruct or impede the implementation of the DTV service; it is suggesting that a mechanism be put in-place to permit adjustments to be made to the table allotments (including channel and power assignments) if the results of additional studies determine a need to do so. Virtually all parties to this proceeding have acknowledged the need for further study, evaluation and testing with regard to a myriad of topics including (but not limited to) adjacent-channel interference, indoor reception, receiver noise figures, non-thermal noise levels and propagation reliability/availability assumptions. The challenge for the Commission is to preserve the spectrum through the adoption of specific channel allotments while leaving in-place a mechanism to modify the allotments based on the results of the activities of a TASO-like organization. AFCCE envisions these as parallel activities, with the Commission taking the lead in establishing the scope of activities (task assignments) and setting hard timetables; the industry must respond by providing talent and financial resources to permit the studies to be completed on a timely but technically sound basis.

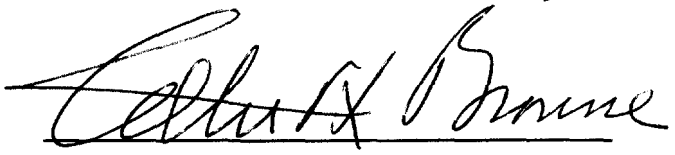
Respectfully submitted,

THE ASSOCIATION OF FEDERAL
COMMUNICATIONS CONSULTING ENGINEERS

Sudhir Khanna, P.E.
President
AFCCE



John F.X. Browne, P.E.
Chairman
Committee on Advanced Television Systems



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